Figure 1

Figure 2

START

Calculate a difference between the sum of pixel values associated with two image blocks. 400

Determine sign bit of the difference. 410

Add sign bit to RNG seed. 420

RNG seed completed? 430

Select different set of data block 440

NO

YES

END

Figure 4

START

Determine RNG seed from content. 300

Input RNG seed into pseudo random number generator. 310

Produce random number sequence. 320

END

Figure 3

START

600 Determine RNG seed.

610 Determine "R_i" based on the RNG seed.

620 Obtain current (i) watermarked data set to recover I_i' and mean (I_i').

630 Obtain prior watermarked data set to recover J' and mean J'.

640 Calculate signal B_j based on differences between data set intensities.

END

Figure 6

$$\begin{vmatrix} I_1 & I_2 \\ I_3 & I_4 \end{vmatrix}$$

START

500 Determine Contrast: $|I_{max} - I_{min}|$.

510 Determine Intensity (I_{total}): $I_1+I_2+I_3+I_4$.

520 Determine Frame Difference: I for pixel in i^{th} frame minus I_{total} for pixel in i-1th frame.

END

Figure 5

740 Compute amplitude (A_i) of the watermark using contrast, intensity frame difference, and perhaps the signs of neighboring data blocks.

750 Multiply (S_i) • (A_i) • (R_i) to compute watermark.

760 Add watermark to original pixel values.

DONE

START

710 Load data set into watermark encoder.

720 Produce a random number sequence (R_i) based on data associated with the data set.

730 Compute secondary data set having constant signal value (S_i).

Figure 7

Figure 8

810_n

810_2 810_3 810_4

810_1

Frame *300*

Figure 9

START

1200 → Load frame (or portion thereof) into watermark decoder

1210 → Produce lower resolution sub-frame

1220 → Perform filtering mechanisms (e.g., enhance edges, remove noise, etc.).

1230 → Extract watermarking signal(s).

END

Figure 12

START

1000 → Load watermarked data set (or portion) into watermark decoder.

1010 → Perform edge enhancement filtering (as necessary).

1020 → Create lower resolution version of the set (sub-frame) each pixel based on a mean signal value of data block.

1030 → Perform noise abatement filtering scheme.

1040 → Perform watermark correlation techniques to extract the watermark.

END

Figure 10

Figure 11

START

1100 — Load compressed bit stream (or portion thereof) into WM decoder.

1110 — Start producing a lower resolution version of a frame of the compressed bit stream.

1120 — Intracoded blocks?

YES → 1125 — Each pixel of lower (solution sub-frame corresponds) to DC value of block.

NO → 1130 — For non-intracoded blocks, each pixel corresponds to weighted averages of DC values of blocks contributing to motion compensation.

1140 — Pseudo-random generator loaded with client's key to select two or more regions of the sub-frame.

1150 — Calculate mean signal value of the first region.

1160 — Calculate mean signal value of the second region.

1170 — Produce a resultant signal value R_i through arithmetic operations on the mean signal values.

1180 — Add $S_i A_i R_i$ to DC value of selected block.

1190 — Watermarking data blocks (pixels) of lower resolution sub-frame completed?

NO →

YES → END